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Patentanmeldung Nr. Patent application No. Demande de brevet n°

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If no title is shown please refer to the description.
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Personal audio system with earpiece remote controller

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Personal audio system with earpiece remote controller

The invention relates to a personal audio system comprising a remotely controllable device and a controller for remotely controlling the device by sending a control signal to the device.

The invention also relates to a controller for remotely controlling a personal audio device.

The invention also relates to a personal audio device which is remotely controllable by a controller.

A personal audio system as described in the opening paragraph is known from the now ubiquitous mobile audio devices like MP3 players and mobile phones. One particular example of such a system is the iPod MP3 player from Apple as reviewed in c't 2002 Heft 26, pages 132-141, "Plattenmeister" by Peter Nonhoff-Arps, Sven Hansen, and available with product no. M8737LL/A (see also http://www.apple.com/ipod/).

This and similar products typically comprise a set of two earpieces also known as ear buds that can be inserted in the ears of the user. These products typically also include a remote controller for controlling one or more functions of the device. A plug connects both the remote controller and the earpieces with the device, by plugging it in a socket of the device. The remote controller is usually included in the wire somewhere between the earpieces and the plug.

As a result, the remote control has no fixed position but is dangling about as part of the wire. Hence, when the user wants to use the remote control for e.g. lowering volume, muting, or skipping an audio track or station, the user first needs to look for the remote controller. Subsequently the user needs to get hold of the controller. This needs to be done such that the controller has the right orientation for operating it. Finally, after being confident about the orientation of the controller, the user may try to find and operate the tiny button to activate the desired function.

This requires considerable time and attention from the user, which may lead to dangerous traffic situations when the user takes part in traffic.

It is an object of the present invention to provide for a personal audio system as described in the opening paragraph that does not suffer from the above mentioned drawbacks.

This object is realized in that the controller has an outer surface with a touch sensitive area, the controller being arranged to be substantially worn in or by a human ear, the controller being further arranged for detecting the touch sensitive area being touched, and for sending the control signal in response to detecting the touch sensitive area being touched.

The remote controller thus gets a fixed position with respect to the user in or by the human ear. It is easy to find one's ear. This prevents looking for the remote controller. In addition, the user is not tempted to look at the remote controller, because there is nothing relevant to be seen for controlling the device. To avoid having to find tiny buttons, merely touching it somewhere on the touch-sensitive area operates the remote controller, which detects being touched and subsequently sends the control signal to the device. Also the problem of finding the proper orientation of the remote controller is solved by wearing the remote controller in or by the ear, because its orientation becomes fixed with respect to the user.

Advantageously, the controller is arranged for fitting substantially in a human ear concha, such that the area is accessible for being touched when the controller is fitted substantially in the concha. This fits in with a particularly comfortable and popular shape for the earpieces or ear buds. The shape consists of a thick disc containing a transducer and a protruding part from which a wire extends. When being worn, the protruding part of the earpiece offers a surface area that is easily accessible for being touched.

Advantageously, the controller is arranged for detecting a temporal pattern in the touch sensitive area being touched, and for sending the control signal in response to detecting the temporal pattern. In general the device offers a plurality of functions and capabilities. Rather than having more buttons on the remote control that may be hard to distinguish, the single touch-sensitive area is used for controlling the plurality of functions. The temporal pattern is a particularly appropriate user interface, because it is easy to create temporal patterns in touching the area rhythmically and because the temporal patterns can constitute a natural and consistent interface. An example is a single short tap for pause/play, double short tap for next track, triple short tap for next artist/album and a long tap for adjusting the volume.

Advantageously, the outer surface has a further touch sensitive area, such that the further touch sensitive area is touched substantially by the ear when the controller is substantially worn in or by a human ear, the controller being arranged for sending the control signal only if the further touch sensitive area is touched. This will prevent the accidental remote control of the device when the remote controller is not worn, thus preventing unwanted activation of the device and unnecessary battery exhaustion.

Advantageously, the controller is arranged for sending a further control signal to the device if the further touch sensitive area is touched. This makes it for example possible for the device to pause playing music as soon as the earpiece is taken out and to resume playing music upon re-insertion.

In an embodiment of the personal audio system according to the invention, the system comprises a second controller for remotely controlling the device by sending a further control signal to the device, the second controller having an outer surface with a further touch sensitive area, the second controller being arranged to substantially be worn in or by a human ear, and the second controller being further arranged for detecting a further temporal pattern in the further touch sensitive area being touched, and for sending the further control signal in response to detecting the further temporal pattern. A second controller fits in with the natural symmetry of the human head. It also considerably enhances the user interface for controlling the device. The symmetry can for example be exploited such that a long tap at the left remote controller decreases the volume, but a long tap at the right controller increases the volume.

The above object and features of the present invention will be more apparent from the following description of the preferred embodiments with reference to the drawings wherein:

Fig. 1 shows a block diagram of an embodiment of a system 100 according to the invention.

Fig. 2 shows an example of an embodiment of the remote controller 120 according to the invention.

Fig. 3 shows an example of the functionality offered by an embodiment of the system 100 according to the invention.

Fig. 4 shows another example of the functionality offered by an embodiment of the system 100 according to the invention.

Fig. 5 shows a block diagram of an embodiment of the remote controller 120 according to the invention.

Fig. 6 shows an example of a touch detection circuit 124 of an embodiment of the remote controller according to the invention.

Throughout the figures, same reference numerals indicate similar or corresponding features. Some of the features indicated in the drawings may be implemented in software, and as such represent software entities, such as software modules or objects.

Fig. 1 shows a block diagram of an embodiment of a personal audio system 100 according to the invention. The personal audio system 100 comprises a remotely controllable device 110 and a controller 120 that remotely controls the device 110 by sending a signal 130 to the device 110.

The remotely controllable device 110 may for example be a device for the reproduction of audio from storage media like tape, disc, memory, CD, DVD and so on. It may also reproduce audio from signals like radio signals or packet streams broadcasted via media like the air, wireless LAN, Internet and so on. The audio source may be portable as the device 110, but the audio can also originate from a home audio set. The device 110 can also be a communication or messaging device like a mobile phone or a personal digital assistant. The device 110 has several functions or capabilities that for example alter the reproduction process, like a function to start playing the next track of a playlist, or to jump to the next channel or station, or to change a volume level, or to change the reproduction speed, or to start or stop a communication session, and so on.

The controller 120 is used for commanding the device 110 to perform one or more of its functions or capabilities. The basic assumption is that the device 110 is remote or tucked away in a pocket or clamped to a belt or clothing, such that operating it becomes relatively hard. The controller 120 makes it possible to operate the device 110. The controller 120 is generally wired to the device 110 by means of a wire 140 (see Fig. 2) and a plug (not shown) that fits into a socket (not shown) of the device 110.

The remote controller 120 has an outer surface 121, see also Fig. 2. The outer surface 121 is just the physical outer side of the controller 120. A part of this outer surface 121 is sensitive to being touched, the so-called touch sensitive area 122. Optionally the controller 120 comprises a second area that is sensitive to being touched, referred to as the further touch sensitive area 123. The touch sensitive area 122 can be realized in many ways,

including a sensor for changes in capacity or induced voltages or currents, a grid of conducting parts between which changes in resistance are measured and detected or an ordinary pressure sensor, button or temperature sensor. Another possibility is to measure and detect changes in an either passive or active electromagnetic field. With the passive variant the controller 120 relies on for example nearby power lines to generate measurable fields when being touched. With the active variant the controller 120 generates an electromagnetic field of its own.

Fig. 5 shows a block diagram of an embodiment of the remote controller 120 according to the invention. The touch sensitive area 122 and the further touch sensitive area 123 are coupled to touch detecting means 124. The touch detecting means 124 measures the internal resistance of a part of the human body that touches the touch sensitive area 122. Fig. 6 shows an example of a circuit for the touch detecting means 124. The internal resistance is determined with a voltage divider composed from the touch sensitive area 122 and a resistor 129. Without touching, the output voltage of the divider will be the supply voltage, but with touching, the output voltage will decrease. Touching can thus be detected. The output voltage of the voltage divider 129, 122 is input for a buffer 127 that provides for a copy of the voltage at its output 128.

The output of the touch detecting means 124 can be coupled to the input of temporal pattern analysis means 125. The temporal pattern analysis means 125 may comprise an A/D-converter (not shown) for converting the analog output signal of the touch detecting means 124 into a digital representation of the output signal. The output signal of the temporal pattern analysis means 125 that represent detected temporal patterns may be coupled to control signal generating means 126, for generating and transmitting the control signal 130 and the further control signal 131.

The control signal 130 send by the controller 120 to the device 110 can take several forms. One example is that the control signal 130 is an electrical DC current that runs upon closing a circuit between a pair of conductors in the wire 140. Also several resistance levels between two pins (not shown) of the plug (not shown) can represent several control signals. Another example is an electrical AC current or voltage with a particular frequency or frequencies. These frequencies may advantageously be above the frequencies perceived by a human ear, so as to be multiplexed on the same wire 140 that carries audio frequencies. Yet another example is a digital electrical signal. Wire 140 may carry the control signal 130, but other media like air or fiber could also carry it, especially in the case of an electromagnetic signal.

According to the invention, the remote controller 120 is suited to be worn in or by a human ear. The remote controller 120 may have various shapes and forms to meet this requirement. It could fit almost entirely in the auditory canal, much like a miniature hearing aid device, but it could also have the shape of a more conventional hearing aid device worn behind the ear cup, or a headset with a band over the head or in the neck, or the shape of a neck strap for carrying the device 110.

Fig. 2 shows an example of an embodiment of the remote controller according to the invention. A particularly comfortable and popular shape of the remote controller 120 consists of a thick disc containing a transducer and a protruding part from which a wire 140 extends. The disc fits in a concha 160 of a human ear 150 and is kept there by friction. The disc may in addition be kept there by the presence of a so-called tragus 170 and antitragus 180, being two cartilaginous edges of the conchal bowl 160 of the human ear 150. When being worn, the protruding part of the remote controller 120 offers a surface area 122 that is easily accessible for being touched.

Fig. 3 shows an example of the functionality offered by an embodiment of the system according to the invention. Fig. 4 shows another example of the functionality offered by an embodiment of the system according to the invention. The functionality of detecting temporal patterns offers a user interface that is convenient, logical and consistent.

A basic temporal pattern that can be detected is a short tap, which consists of the touch sensitive area 122 being initially untouched and subsequently being touched for a short while, and subsequently being untouched again. The short while lasts typically between 40 and 300 milliseconds. Another basic temporal pattern is the long tap, which lasts typically between 400 milliseconds to several seconds. Yet another basic temporal pattern is a repeated long or short tap or another sequence of long and short taps. All these temporal patterns may each be mapped to functions or capabilities of the device 110.

The detection of the temporal pattern is preferably insensitive to deviations to the duration of the tap and to the criteria for determining being touched, like measured quantity levels and hysteresis. The detection of the temporal pattern may adapt itself to the history of detected patterns.

One particular mapping may for example be that, in response to detecting a touch and hold, the device 110 gradually adapts a volume level as long as the area 122 is being touched. The direction of adaptation (increasing or decreasing the volume level) can be reversed with every touch and hold, or with a short tap in between.

The system 100 may comprise two controllers 120, one for each ear of the user. The temporal patterns detected by the system 100 may depend on the aggregate of each of the four areas of the controllers 120 being touched, such that for example more exotic functions require substantial simultaneous tapping on both controllers 120.

To provide for a consistent user interface with a system 100 with two controllers 120, the system may have a function to swap the temporal patterns between the controllers 120 if the left and right controller are inserted in the right and left ear respectively. This function effectively swaps the remotely controlled functionality between the controllers 120. Assuming that the user always first inserts either controller 120 in for example the left ear, the function may be triggered by determining the controller 120 that is inserted first.

To further enhance the user interface, the device 110 may provide immediate acoustic feedback in response to being touched. One example of such feedback is providing an audible hum or beep when the area 122 is detected as being touched. Another example is that the audio feedback represents the activated function of the device 110, for example by varying volume, pitch, rhythm or melody or combinations thereof of the audio feedback. Yet another example of feedback is the use of a recorded or synthesized human voice informing the user about the activated function of the device 110 or about the capabilities of the device 110 and how to remotely control them.

The controller 120 may favorably be backward compatible with devices according to the prior art, such that the controller 120 according to the invention can be plugged in and used with conventional devices. Similarly the device 110 may be backward compatible with controllers according to the prior art, such that the device 110 according to the invention can still (partially) be remotely controlled from conventional controllers.

In the above description, both the sensing functionality as well as the detecting functionality of being touched have been implemented at the remote controller 120. Another possibility however is to allocate only the sensing part (this is the measurement of a quantity) at the controller 120, while allocating the detecting part, in particular the temporal pattern analysis means 125, at the device 110. This may offer advantages like reducing the complexity of the remote controller 120, while the device 110 may already have the means to perform the detection, especially when it is done partially or as a whole in software.

The number of wires between the remote controller 120 and the device 110 can be reduced by applying a so-called phantom power supply providing power to for example the touch detecting means 124 in the remote controller 120.

It is noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

CLAIMS:

1. A personal audio system (100) comprising a remotely controllable device (110) and a controller (120) for remotely controlling the device (110) by sending a control signal (130) to the device (110), the controller (120) having an outer surface (121) with a touch sensitive area (122), the controller (120) being arranged to substantially be worn in or by a human ear (150), the controller (120) being further arranged for detecting the touch sensitive area (122) being touched, and for sending the control signal (130) in response to detecting the touch sensitive area (122) being touched.

2. A personal audio system (100) as claimed in claim 1, characterized in that the controller (120) is arranged for fitting substantially in a human ear (150) concha (160), such that the area is accessible for being touched when the controller (120) is fitted substantially in the concha (160).

3. A personal audio system (100) as claimed in claim 1, characterized in that the controller (120) is arranged for detecting a temporal pattern in the touch sensitive area (122) being touched, and for sending the control signal (130) in response to detecting the temporal pattern.

4. A personal audio system (100) as claimed in claim 3, characterized in that the outer surface (121) has a further touch sensitive area (123), such that the further touch sensitive area (123) is touched substantially by the ear (150) when the controller (120) is substantially worn in or by a human ear (150), the controller (120) being arranged for sending the control signal (130) only if the further touch sensitive area (123) is touched.

5. A personal audio system (100) as claimed in claim 4, characterized in that the controller (120) is arranged for sending a further control signal (131) to the device (110) if the further touch sensitive area (123) is touched.

6. A personal audio system (100) as claimed in claim 4, characterized in that the system (100) comprises a second controller (120) for remotely controlling the device (110) by sending a further control signal (131) to the device (110), the second controller (120) having an outer surface (121) with a further touch sensitive area (123), the second controller (120) being arranged to substantially be worn in or by a human ear (150), and the second controller (120) being further arranged for detecting a further temporal pattern in the further touch sensitive area (123) being touched, and for sending the further control signal (131) in response to detecting the further temporal pattern.

7. A controller (120) for remotely controlling a personal audio device (110) by sending a control signal (130) to the device (110), the controller (120) having an outer surface (121) with a touch sensitive area (122), the controller (120) being arranged to substantially be worn in or by a human ear (150), the controller (120) being further arranged for detecting the touch sensitive area (122) being touched, and for sending the control signal (130) in response to detecting the touch sensitive area (122) being touched.

8. A personal audio device (110) remotely controllable by a controller (120), the controller (120) having an outer surface (121) with a touch sensitive area (122), the device (110) being arranged for detecting the area being touched, and for activating a function of the device (110) in response to detecting the area being touched.

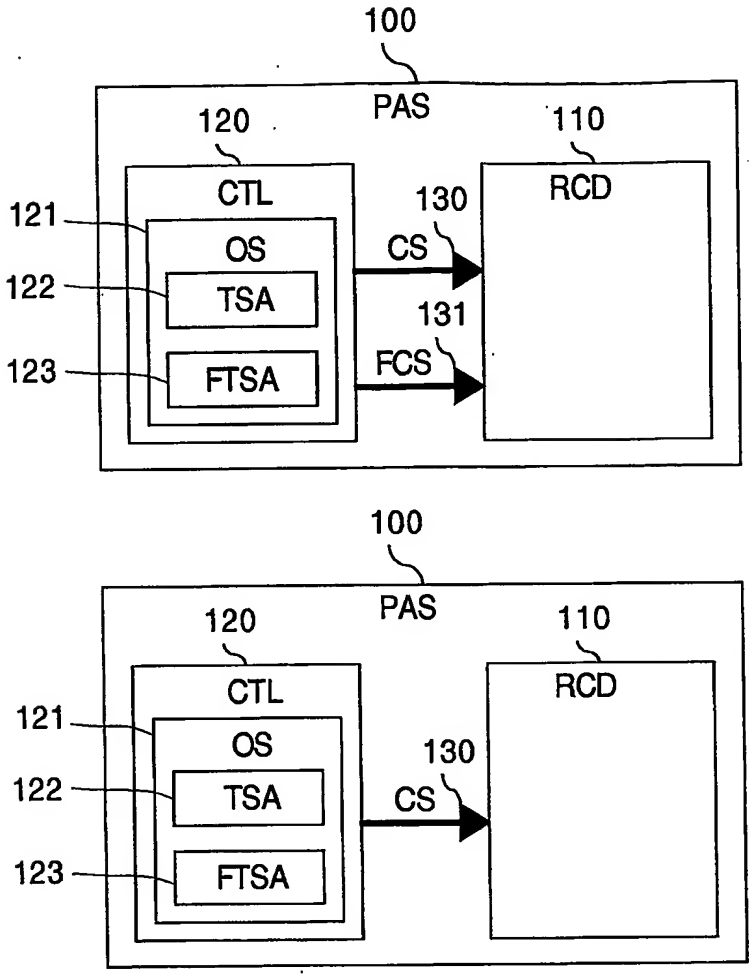
9. A method for remote control of a personal audio device (110) comprising:

- wearing a controller (120) substantially in or by a human ear (150);
- detecting a touch sensitive area (122) of the controller (120) being touched; and
- sending a control signal (130) to the device (110) in response to detecting the area being touched.

ABSTRACT:

In a personal audio system 100 a remote controller 120 has a touch sensitive area 122 and is being worn in or by a human ear. A temporal pattern in the area 122 being touched is detected and used for remotely controlling a device 110 for personal audio by means of a control signal 130. This prevents the hassle involved in finding, manipulating and operating a conventional remote control that is typically dangling somewhere along a wire.

Fig. 1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CTL
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OS
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TSA
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FTSA
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CS
131
FCS
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PAS
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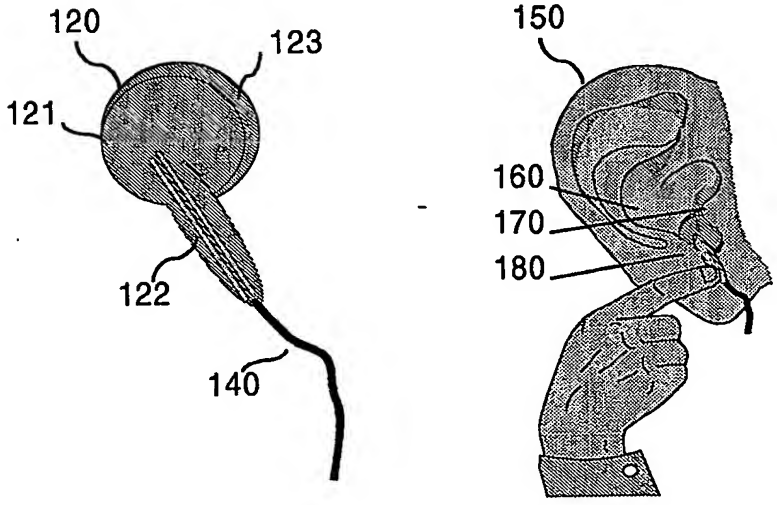
CTL
121
OS
122
TSA
123
FTSA
130
CS
110
RCD

FIG.1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121
122
140
150
160
170
180

FIG.2

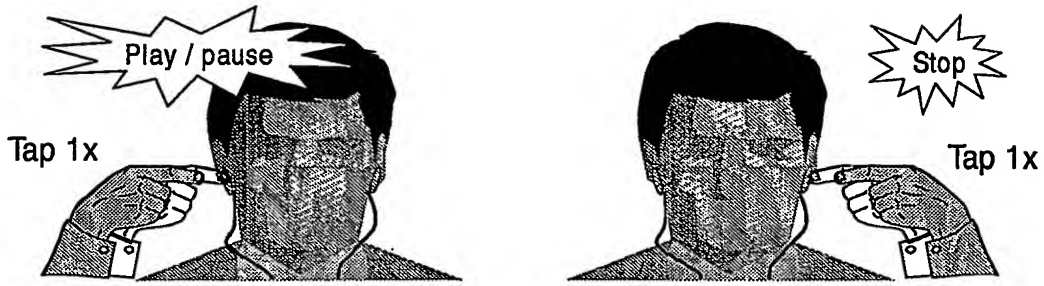
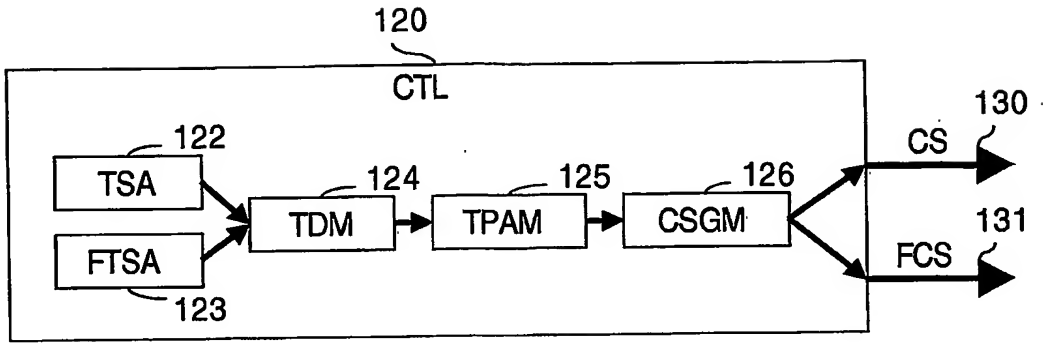


FIG.3

FIG.4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CTL
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TSA
FTSA
123
124
TDM
125
TPAM
126
CSGM
130
CS
131
FCS

FIG.5

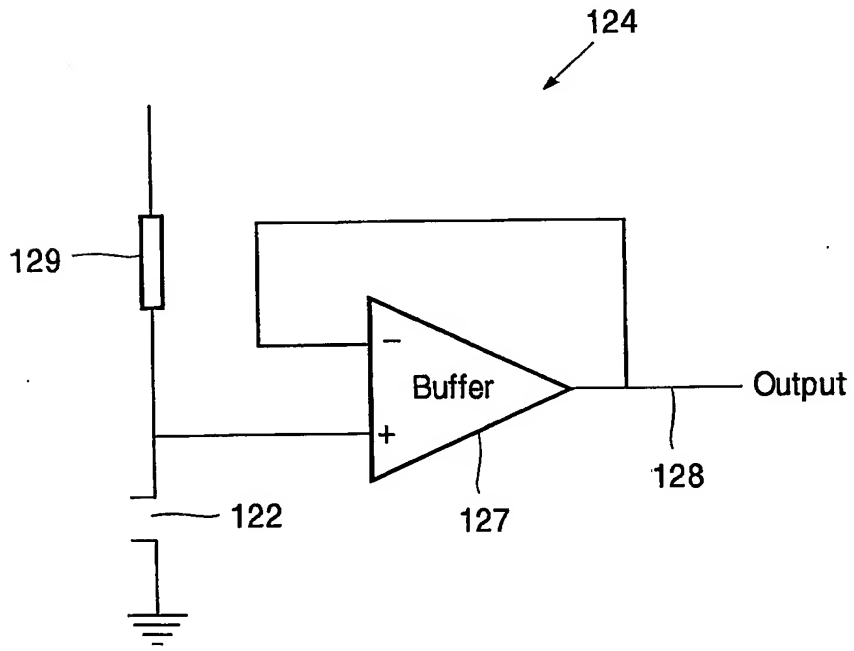
124
129
Buffer
Output
122
127
128

FIG.6